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NASA-02473 (June 2004)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA

Superseding NASA-02473 (May 2004)

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06/04

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SECTION 02473

DRILLED CONCRETE PIERS

06/04

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers cast-in-place concrete pier foundations for structures including underreaming. This section includes shoring, bracing and removing pier casings, concrete materials for drilled piers, reinforcement, anchoring and dowels, sampling and testing of concrete, testing of pier foundations, clean up and waste disposal.

Include Section 03305 CAST-IN-PLACE CONCRETE (SHORT SECTION).

Drawings must include location of piers, diameters of shafts, dimensions of bells, height and slope angles, bottom and top elevations, details of reinforcing steel, dowel details including dowels for construction joints, anchors, and bearing caps.

Data on subsurface conditions include: boring data; spoon samples, particularly at depth footing will be formed, relative density of all soils encountered; and ground water table information.

When drilled pier designs are required, test borings must be provided in sufficient number and locations and driven 6 feet 1830 millimeter deeper into bearing strata to check continuity, fissures, and stability of strata.

Any known underground structures and utilities must be identified and disposition indicated.

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically

be deleted from this section of the project specification.

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The publications listed below form a part of this section to the extent referenced:

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

30 CFR (1994) Mineral Resources, Chapter 1

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

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The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Construction Equipment List shall be submitted.

SD-02 Shop Drawings

Fabrication and erection Drawings shall be submitted for the following proposed items:

Shoring
Bracing
Steel Casing
Safety Tubes
Reinforcing Steel Details
Dowels and Anchor Bolts

SD-03 Product Data

Manufacturer's catalog data shall be submitted on all major equipment to be used, in accordance with paragraph entitled, " Construction Equipment List," of this section.

SD-06 Test Reports

Test report shall be submitted in accordance with paragraph entitled, "Reports," of this section.

Gas test shall be submitted in accordance with paragraph entitled, "Gas Protection," contained within this section.

Other test reports are to include:

Concrete Test

The Contractor shall submit the following records in accordance with the applicable paragraph's contained within this section:

Daily Progress Report
Drilling Record for Each Pier
Record of Gas Readings
Inspection Notices

SD-07 Certificates

A Listing of Product Installations shall be submitted in accordance with paragraph entitled, "Listing of Product Installations," of this section.

Qualification of gas inspector shall be submitted in accordance with the paragraph entitled, "Gas Protection," of this section.

Submit safety plan in accordance with paragraph entitled, "Safety Provisions," of this section.

1.3 DEFINITION OF DRILLED PIER

A drilled pier shall mean an end bearing cast-in-place concrete foundation with a minimum diameter of 12-inches 305 millimeter, formed by machine-drilling a hole to the specified depth and filling with concrete and reinforcing steel.

1.4 PROGRESS REPORTS AND RECORDS

Contractor shall submit a Daily Progress Report and Drilling Record for Each Pier. Report shall contain the date of starting work and depth drilled per day.

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NOTE: Special protection requirements must be indicated on the drawings.
****

1.5 PROTECTION OF WORK

Drilled piers shall be protected from damage due to premature use, mechanical disturbances, shock or vibration, undermining, and washout.

1.6 SAFETY PROVISIONS

1.6.1 Steel Casings

Full-length steel casings of sufficient thickness shall be provided to withstand compressive displacement and withdrawal stresses and to maintain walls of the excavation. Casings may be left in place or may be pulled as concrete is placed, at the Contractor's option, unless otherwise directed.

1.6.2 Hoists and Safety Devices

Approved safety devices and safe means of ingress to and egress from the bottom of excavations shall be provided for personnel. Each person shall

be provided with a properly rigged safety harness and life line. The life line shall be separate from other lines. Persons being raised or lowered in the shaft by means of a bucket shall be required to wear safety belts.

Properly trained safety personnel shall be provided at the top of the pier shaft when workmen or inspectors are in the shaft. Safety personnel shall be responsible for the safety of persons in the shaft and shall relay lift signals to the hoist operator.

Adequate stand-by mechanical equipment shall be provided for emergency use.

1.6.3 Gas Protection

Applicable rules of 30 CFR shall be observed for pier excavation and work in soils known or suspected to be gaseous.

Persons other than a qualified gas inspector shall not enter a drilled pier until air has been checked for toxic and explosive gases and approved for entry.

The Contractor shall have employees trained in the operation of gas-testing equipment and qualified as gas inspectors who shall be on duty when workmen are in the drilled piers. The inspectors' primary function shall be to test for gas and be responsible for operation of testing equipment. Unless equipment of the constant supervisory type with automatic alarm is employed, tests for gas shall be made at intervals of 2 hours, or less when the character of the ground or experience indicates that gas may be encountered. A test for gas shall be made before workmen are permitted to enter the excavation after an idle period exceeding 1/2 hour.

Readings shall be made with approved instruments by the gas inspector. Readings shall indicate the concentration of gas, number and location of drilled piers, point of test, and date and time of test. Readings shall be entered as a permanent Record of Gas Readings.

****
NOTE: Insert ventilation pressure in first sentence.
****

Air in drilled piers shall be maintained free of gas and shall be ventilated by means of positive mechanical ventilation of at least [_____] cubic feet per minute cubic meter per second at a static pressure of 4-inches 1,000 pascal water gage. Supply air shall be delivered at a point 10 feet 3048 millimeter or less from the bottom of the pier.

If gas is found to be present in an amount constituting an explosive mix or health hazard, work in the drilled pier shall be suspended until air is made safe for work by special ventilation methods or the method of excavation is changed to prevent entrance of gas.

1.7 SAMPLING AND TESTING

A sampling and testing service shall be provided by the Contractor. Testing services shall be approved and shall perform sampling and testing for quality control.

Except when specified otherwise, one laboratory report shall be submitted for each reference specification. Additional reports will be required if material or material source changes.

1.8 CONSTRUCTION EQUIPMENT LIST

Construction Equipment List for all major equipment to be used in this section shall be submitted to the Contracting Officer prior to start of work.

1.9 SHOP DRAWINGS

Fabrication and erection drawings shall be submitted for Shoring, Bracing, Steel Casing, Safety Tubes, Reinforcing Steel Details and Dowels and Anchor Bolts to specification as described in the plans, prior to the start of work.

1.10 LISTING OF PRODUCT INSTALLATIONS

A Listing of Product Installations similar to the specified work contained within this section shall be submitted. The written statement shall include the proposed pier organization giving qualification of personnel. The written statement should show proof of at least [five] [_____] years experience by the organization in this particular type of foundation work. Personnel working pursuant to this section, may at the Contracting Officer's option, be required to demonstrate technical competence by performing sample work [and/or by displaying their state qualifications/certificates], at no additional cost to the Government.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall be Class 3A and conform to the requirements of Section 03305 CAST-IN-PLACE CONCRETE (SHORT SECTION).

2.2 REINFORCEMENT

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NOTE: Insert reinforcement grade.
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Reinforcement shall conform to Section 03305 CAST-IN-PLACE CONCRETE (SHORT SECTION) and shall be Grade [_____].

PART 3 EXECUTION

3.1 PIER DRILLING

3.1.1 General

Holes for piers shall be drilled to the depth indicated. Pier bases to be "belled-out" shall be belled within strata as indicated.

Casings shall be installed as the drilling proceeds so that earth walls are maintained without movement into the shaft excavation. When an elevation is reached which is expected to be the top of the bell, casing may be stopped and a smaller inner section, if required for safety of personnel, shall be carried down to the bearing strata. The inner section referenced shall not extend above the actual top of the bell so as to reduce the diameter of the pier. Particular care shall be exercised in withdrawing temporary casings, as specified under concrete placing.

In the event that casings are required, the Contractor may abandon casings, provided no extra expense to the Government is involved, or casings may be removed in lifts as each lift of concrete is placed in such a manner that the bottom of the casings remains below the top of the concrete being placed and the head of the concrete above the bottom of the casing is greater than that of any drilling mud and water on the outside of the casing, until the top of the concrete is level with or above unstable earth.

3.1.2 Drilling Tolerances

The centerline of the shaft and bell of drilled piers shall be on the centerline of columns or walls unless otherwise indicated.

The actual center of each pier shaft shall be within 1 inch 25.4 millimeter of the design center at the cutoff line. Its center at any other horizontal plane shall not be out of plumb from the designed center at the cutoff line by more than 1 percent of the distance from the cutoff line to the particular horizontal plane struck, but the center shall not deviate from the actual vertical axis of the pier more than 5 percent of its design diameter at such plane.

The maximum tolerance from plumb in any one hole, measured in center of hole, shall not exceed 1/16-inch per foot 1.6 millimeter per 305 millimeter of depth.

If these tolerances are exceeded, proper additional construction as required shall be provided without additional cost to the Government.

3.1.3 Removal of Obstructions

Substructures and other obstructions below grade that interfere with the work shall be demolished and removed. Underground utilities encountered during drilling shall be protected until proper identification is made. If utilities are abandoned, the interfering portions shall be removed as obstructions. If utilities are to remain in service, the Government will provide for relocation.

If, during the process of drilling excavation, unforeseen obstructions, concrete or masonry substructures, boulders, or underground utility lines are encountered and not indicated on drawings, the Contractor shall cease work immediately and make a report in writing. The Contractor will be instructed as to the proper procedure.

3.1.4 Dewatering

If excessive water is encountered, the Contractor may either pregrout, excavate by pneumatic methods, or use other approved means to reduce or prevent entry of excessive water into the excavation.

Discharge lines shall be provided and maintained to carry water away from areas of building construction and to conduct the water to general site run-off ditches and disposal areas. Additional ditching required to connect to site drainage shall be provided.

3.1.5 Bells or Bearing Surfaces

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NOTE: Drawings must be coordinated with

requirements of this paragraph.
****

Bell diameter, height, and slope angle shall be as indicated.

Where soil conditions are encountered that make it impractical to undercut bells to the required dimensions, roofs of bells shall be arched or shored with wood or steel shoring resting on the bearing strata of sufficient strength and spacing to support the earth against cave-in or collapse. Shoring shall be left in place if the roof has tendency to cave, otherwise it may be removed before concreting. Wood shoring shall not be used when safety is a concern.

Bottoms of bells shall be excavated level and cleaned free of loose material before concrete is placed.

3.1.6 Inspection

Pier shafts and bells shall be inspected and approved before concrete placing is permitted.

The Contractor shall provide facilities to inspect and test each pier shaft and bell.

Inspection Notices shall be submitted at least 6 hours prior to the time piers will be ready for inspection and testing.

3.1.7 Depth of Bearing Strata

In case the indicated depth is reached without reaching bearing strata, the Contractor shall cease drilling and advise the Contracting Officer immediately. The Contractor will be directed as to proper application of appropriate procedures.

3.1.8 Overexcavation

The Contractor will not be paid for overexcavation when pier holes are drilled to a greater depth than required. Overexcavation shall be filled with concrete. Such piers shall be measured and costs will be paid in accordance with the design length only.

3.1.9 Placing Reinforcement

Reinforcement shall be placed in accordance with Section 03305 CAST-IN-PLACE CONCRETE (SHORT SECTION).

3.1.10 Anchor Bolts

The Contractor shall set to template all anchor bolts, leveling plates, and accessories furnished under work of other sections.

3.2 PLACING CONCRETE

Concrete shall be placed in accordance with Section 03305 CAST-IN-PLACE CONCRETE (SHORT SECTION).

3.3 DISPOSAL OF WASTE MATERIALS

3.3.1 Removal to Spoil Areas on Government Property

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NOTE: Delete the paragraph heading and the following paragraph when disposal on Government property is not permitted.
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Waste material shall be transported to and disposed of in designated spoil areas on Government property.

3.3.2 Removal from Government Property

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NOTE: Delete paragraph heading and the following paragraph when disposal on Government property is permitted.
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Excavated materials shall be removed from Government property and legally disposed at no additional cost to the Government. Permits and fees for disposal shall be paid by the Contractor.

3.4 REPORTS

Five copies of each test report shall be submitted within 4 calendar days after completion of tests. In addition, a test report for each pier shall be included.

Concrete Test shall be submitted in accordance with Section 03305 CAST-IN-PLACE CONCRETE (SHORT SECTION).

-- End of Section --